Off Plane Grating Calibration at BNL

- John Seely, Martin Laming (NRL)
- Benjawan Kjornrattanawanich (BNL)
- Kathy Flanagan, Ralf Heilman (MIT)
- Andy Rasmussen (Columbia)
- and support from others in beamline setup, supplying gratings, AFM measurements, …

Off-Plane Reflection Efficiencies

Triangular Groove

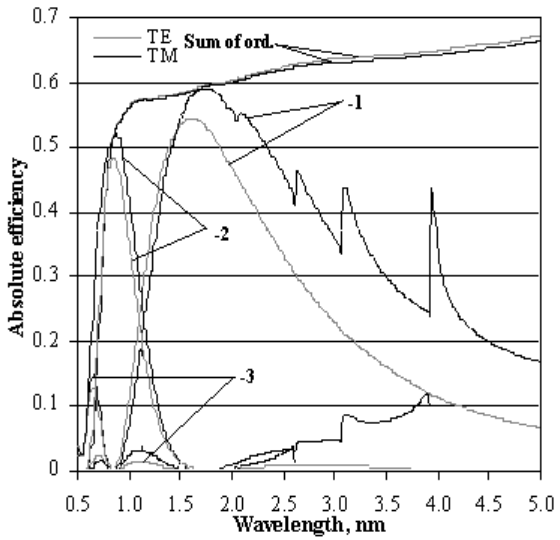


Fig. 8. Absolute efficiency in the –1, –2, and –3 orders of a 5000-gr/mm triangular grating with 7° working facet angle and 5-Å rms roughness calculated as a function of wavelength for the 7° polar and 88° azimuth incidence angles and the off-plane mounting.

Trapezoidal Groove

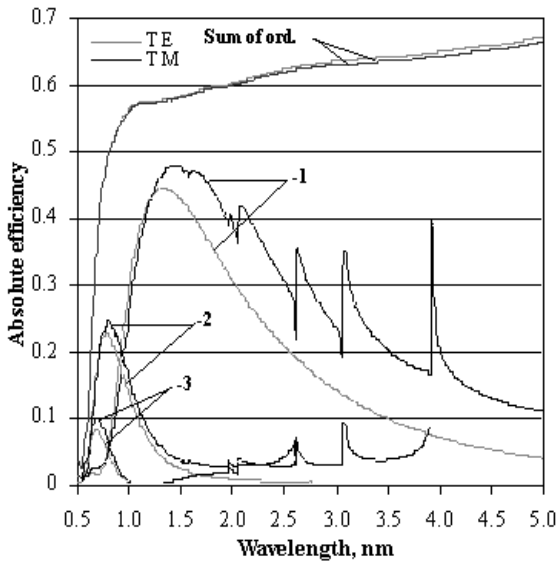


Fig. 9. Same as in Fig. 8 but for a trapezoidal grating.

Polygonal Groove

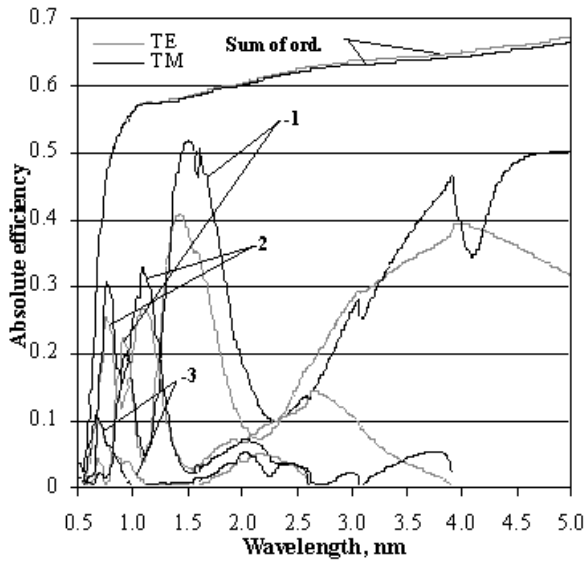
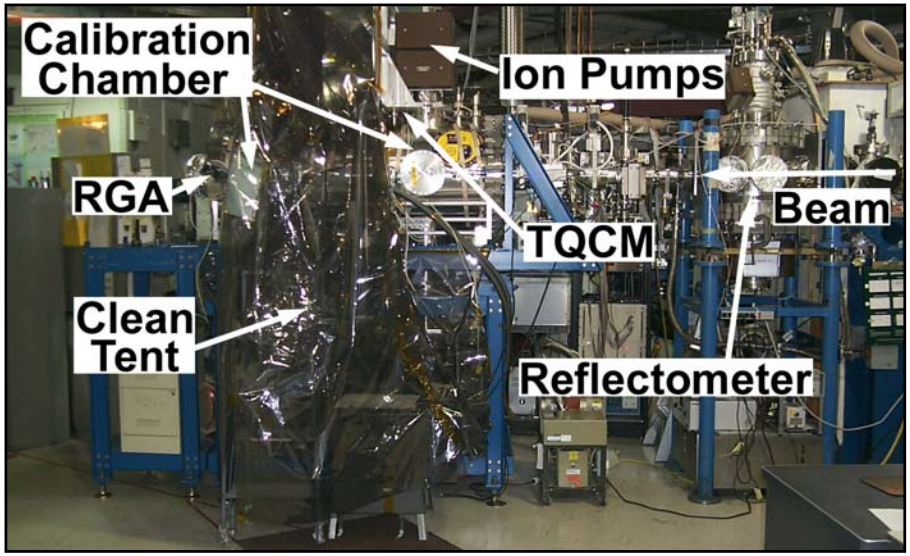
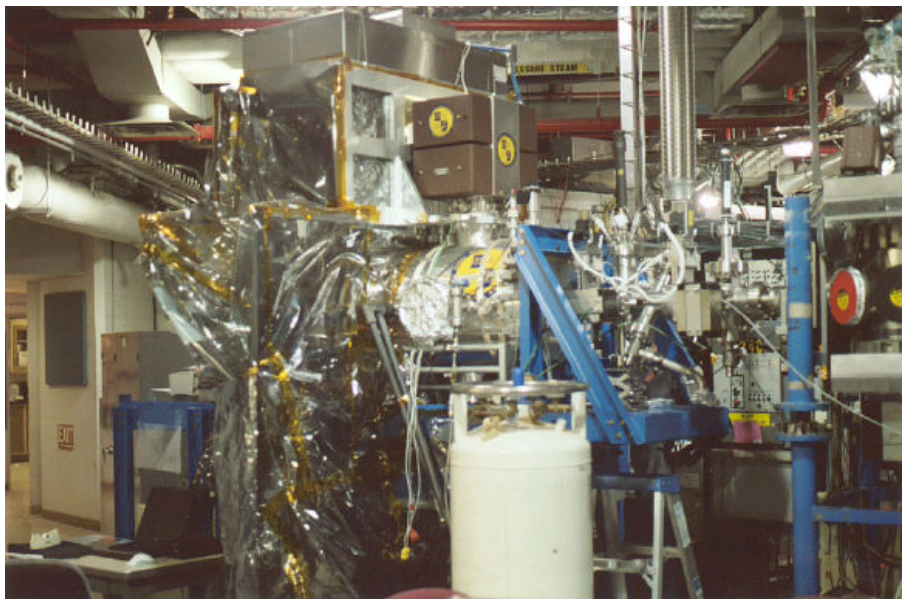


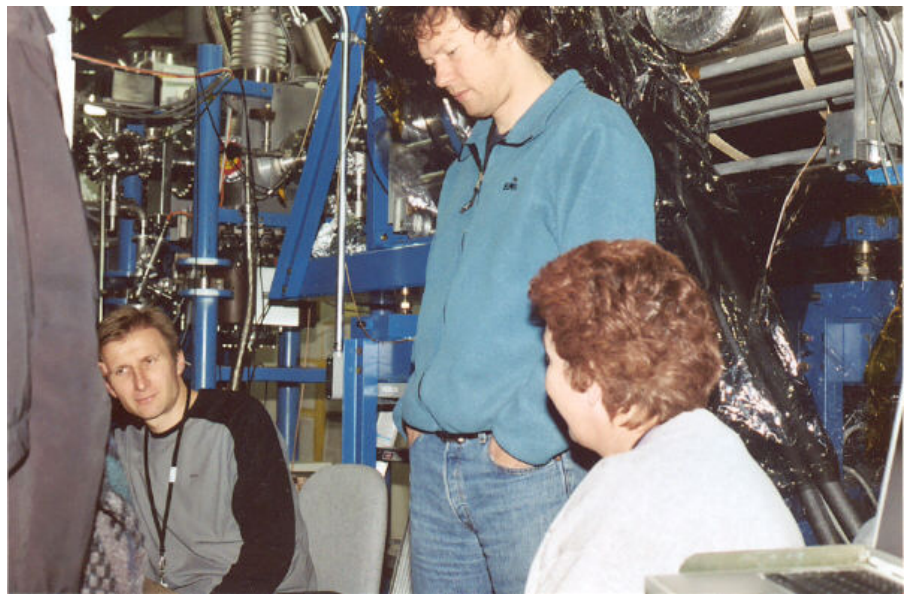
Fig. 10. Same as in Fig. 8, but for a polygonal grating.

- Off-plane offers higher efficiency, factor of 2-3 more than in-plane, due to more advantageous groove illumination function. Can be as high as 50-60%. Also offers potentially higher spectral resolution.
- Biggest difference to in-plane geometry is polarization sensitivity, predicted using the code PCGRATE developed by Leonid Goray et al.; for more information see www.pcgrate.com



Views of X24C beamline at BNL/NSLS and hardworking experimenters!





TE & TM Polarization at BNL/NSLS

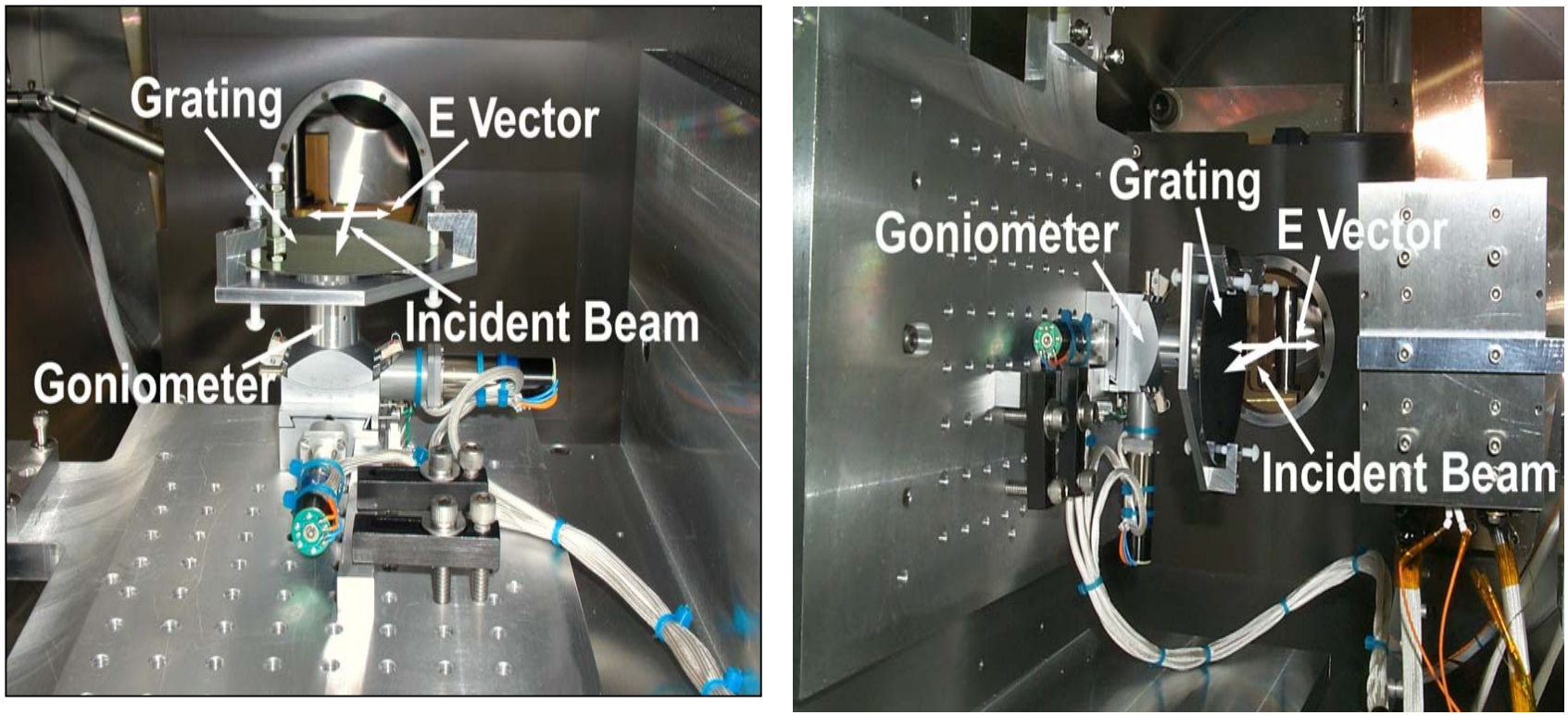
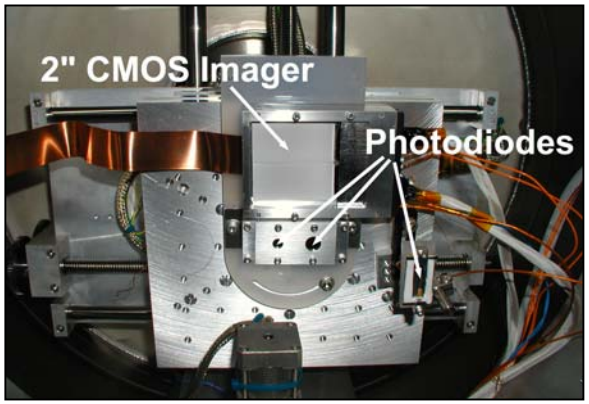
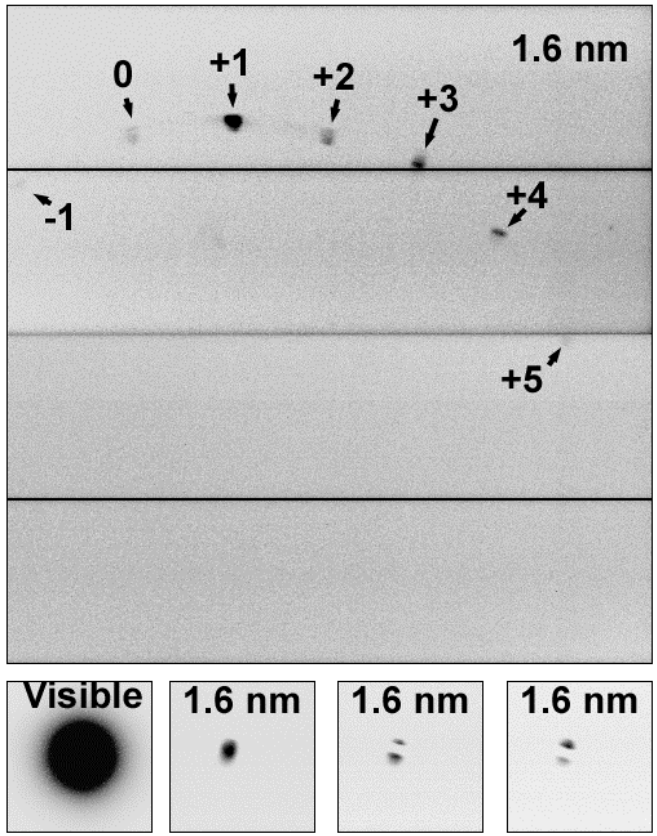


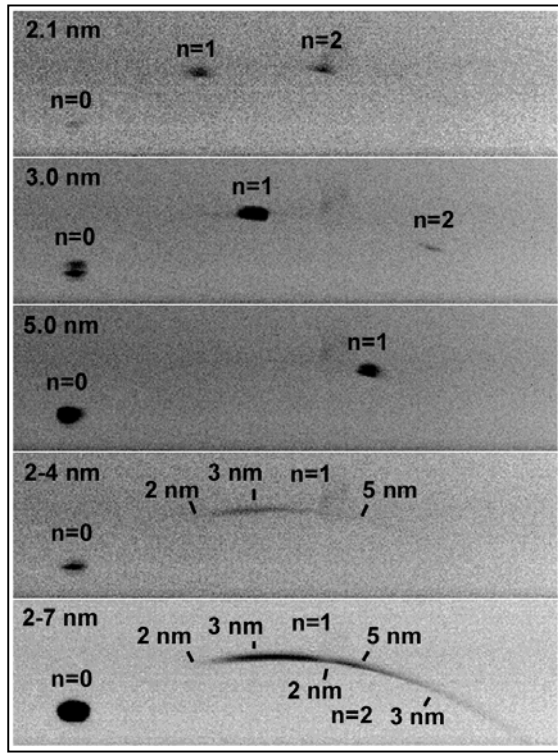
Fig. 2. The MIT *Constellation-X* test grating in the TM (left) and TE (right) orientations.

The Conical Diffraction Pattern Displayed on a CMOS Detector



Above: The CMOS imager and the three photodiodes mounted on the detector plate. Right: CMOS image of the conical diffraction pattern for a wavelength of 1.6 nm. Shown below the CMOS image are subimages of the visible light beam and the 1.6 nm beam.





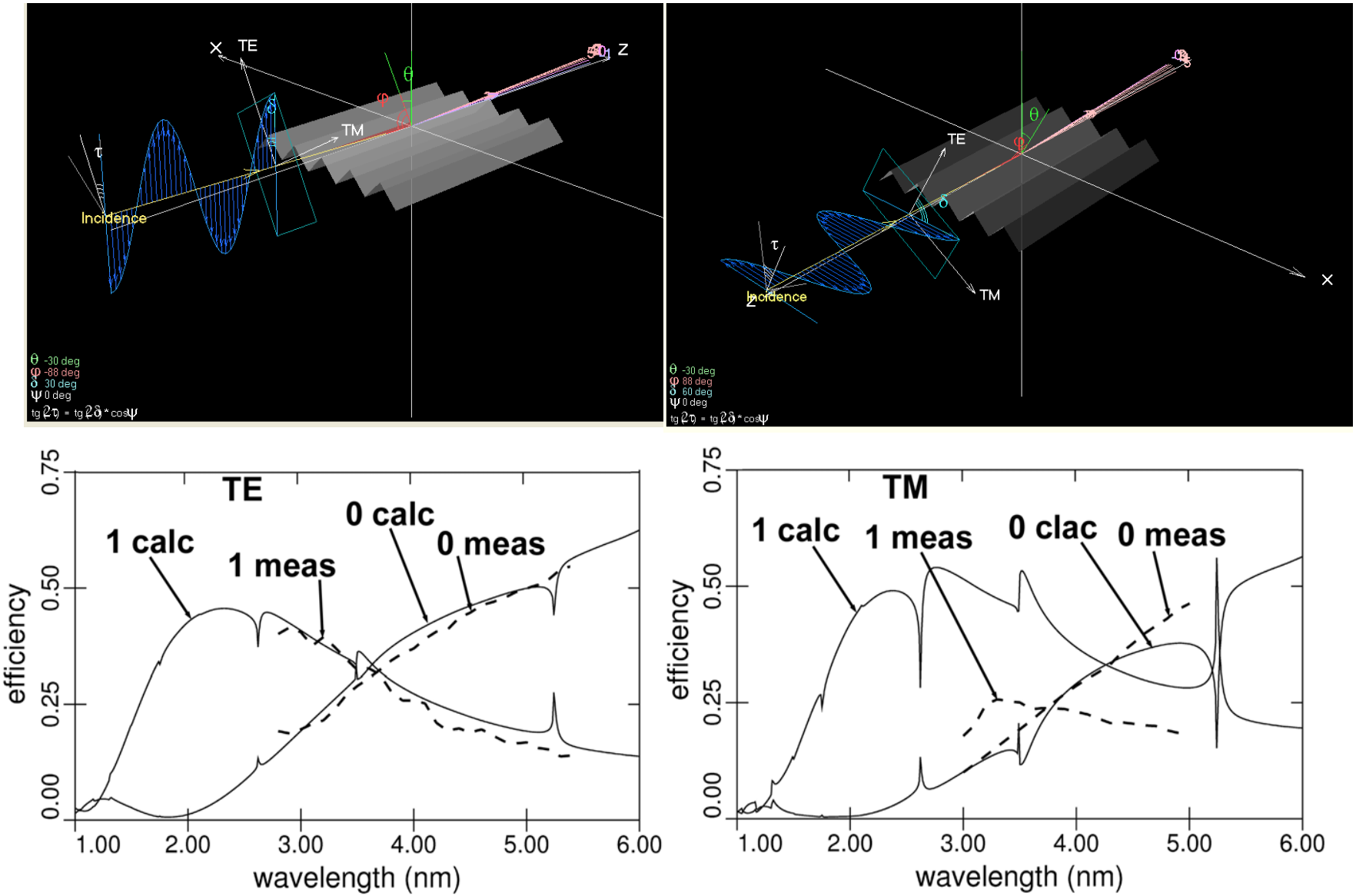


Fig. 8. Top: The geometry for the TE (left) and TM (right) grating orientations. Bottom: The calculated (solid curves) and measured (dashed curves) efficiencies for the TE (left) and TM (right) orientations.